

the xylol-absolute-alcohol process into a saturated solution of xylol and paraffine, then infiltrated with paraffine, imbedded, and sectioned with a microtome; again, the sections were counter-stained on the slide with Bismarck brown and mounted in xylol-balsam.

Acknowledgments are due Dr. John M. Coulter and Mr. D. M. Mottier of Indiana University for their valuable suggestions given in the direction of my work.

Indianapolis High School.

A vacation in the Hawaiian islands.

DOUGLAS HOUGHTON CAMPBELL.

As the vacation approached, the question arose, "Where shall I go for the summer?" With the numerous interesting regions within comparatively easy reach of San Francisco, this question was not to be answered without some deliberation; but finally the Hawaiian islands were decided upon, as promising much of interest, both botanical and otherwise.

Hillebrand's Flora of the Hawaiian islands was procured; from it I obtained some idea of what might be expected in the way of vegetation, and with much interest I looked forward to the moment when, for the first time, I should find myself roaming in a tropical forest.

On the 6th of July, behold me, then, a passenger on the Australia, bound for Honolulu. There is very little to record of the voyage, which was pleasant enough but not eventful. One is struck by the paucity of life in the Pacific after getting away from the immediate vicinity of land. None of the giant kelps, so characteristic of the coast region, were seen after the first day out, nor was any floating sea-weed observed during the trip. Animal life was confined to a few sea-birds, mostly "gonies," small brown albatrosses, which followed the ship for several days. As the warmer waters were reached, flying fish became abundant, but they were pretty much the only animals noted on the way over. Not a vessel of any kind was seen after the first day, and the vast stretch of blue water was unbroken by any sign of life. The water is enormously deep, and of a blue so vivid, that one can almost believe that a handkerchief dipped into it would come out blue.

On awakening upon the seventh day out, and looking through the port-hole of my state room, I saw that we were sailing near land. Rugged barren looking hills were seen; and, going upon deck, I learned that this was Oahu, the island upon which Honolulu is situated. As we skirted the shore at a distance, I soon spied a grove of unmistakable cocoa palms, the first hint of the tropical vegetation to which I was soon to be introduced. Beyond was the bold promontory of Diamond Head, an extinct volcanic crater, forming a great bowl with rugged sides, right at the water's edge. Beyond this, and bounded partly by it, is the bay upon whose shores stands the city. Back of it rose abruptly a chain of mountains, in places about three thousand feet above sea-level, and furrowed by deep valleys, whose walls, as well as the cloud-capped summits of the hills, were covered with the most wonderfully verdant vegetation. Never before had I realized the possibilities of green. Blue greens, yellow greens, gray greens, and positive greens, with all degrees of these and others that are indescribable, combined to form what Whistler would term a symphony in green.

As if to vie with the colors of the mountains, the sea exhibited an equally wonderful variety of tints. Outside the harbor is a coral reef, and within this the water is of the pale green common to shallow ocean water; but outside it deepens very rapidly into the vivid blue of the open ocean. From a distance the line is clearly seen; but, as the observer approaches shore, the water changes from deep blue through every shade of blue and green until the pale green of the water within the harbor is reached.

As we approached land numbers of the queer outrigger canoes of the natives were met, and from the wharf boys jumped into the water and swam about the ship in the hope of persuading some of the passengers to throw over to them coins, which they are very skillful in diving for.

On the way to the hotel a few gardens were passed, and in them everything was strange. By far the most striking thing was the superb *Poinciana regia*. Although I had never seen this before I recognized it in an instant from a description of Charles Kingsley's, read long ago. Surely in the whole vegetable kingdom there is no more splendid plant. A spreading flat-topped tree, perhaps thirty feet high, with feathery green, acacia-like foliage and immense flat clusters of big

flaming scarlet flowers that almost completely hide the leaves so that the tree looks like an immense bouquet. They were in their prime about the time of my arrival in Honolulu and continued to flower more or less for the next six weeks. Pretty much everything in Honolulu, except the cocoanuts and an occasional haw tree (*Paritium tiliaceum*) is planted; but people seem to vie with each other in seeing how many different kinds of plants they can grow, and the result is that the place is like one great botanical garden. To Dr. Hillebrand this is said to be largely due, as he was one of the first to introduce foreign ornamental plants, and his place, which is kept much as it was at the time he left the islands, was a very remarkable collection of useful and ornamental plants from the warm regions of almost the whole globe.

Probably the first thing that strikes the traveler from the cooler regions is the great variety and number of palms. Of these the beautiful royal palm (*Oreodoxa regia*) is easily first. With its smooth columnar trunk, looking as if it had been turned, encircled with regular ring-shaped leaf-scars, and its crown of plummy green leaves, it well deserves its name. Other characteristic palms are various species of betel palms (*Areca*), wine palm, (*Caryota*), sugar palm (*Arenga*), and a great variety of fan-palms of different genera. None is more beautiful than a thrifty young cocoa palm, but unfortunately it is very subject in the Hawaiian islands to the ravages of some insect which eats the leaves and often renders them brown and unsightly. Indeed, it is almost impossible to find a specimen which is not more or less disfigured by this pest. The trunk of the cocoanut tree is usually more or less crooked, and in old specimens much too tall for its thickness, so that the old trees look top-heavy. The date palm flourishes in Honolulu, where it is quite dry, but does not do so well in the wetter parts of the islands.

On studying the other trees, one is struck at once by the great preponderance of Leguminosæ, especially Cæsalpineæ and Mimoseæ. All about the town, and growing very rapidly, is the algaroba (*Prosopis juliflora*), a very graceful tree of rapid growth, with fine bipinnate leaves and sweetish yellow pods, which animals are very fond of, and which are used extensively for fodder. Add to this that the tree now forms the principal supply of fuel for Honolulu and we can realize its full value. Other leguminous trees that are planted are

the monkey-pod (*Pithecolobium samang*), tamarind, various species of *Bauhinia* and *Cathartocarpus*. One species of the latter with great drooping bunches of golden yellow flowers and enormous cylindrical pods three or four feet long, rivals the *Poinciana* when in full flower.

Mingled with these are a great number of shrubs and trees with showy flowers or leaves, most of them more or less familiar to the stranger, either from pictures or from greenhouse specimens. Several species of *Musa* are grown, and when sheltered from the wind are most beautiful; but ordinarily the leaves are torn into rags by the wind. The tall and graceful *M. sapientium* has been largely supplanted by the much less beautiful Chinese banana, *M. Cavendishii*, which is short and stumpy in growth, but enormously prolific. The related traveler's tree (*Ravenala Madagascariensis*), is a common and striking feature of many Hawaiian gardens. Of the many showy flowering shrubs, the beautiful *Hibiscus Rosa-Sinensis* is one of the commonest, and is used extensively for hedges. One of the most striking hedges in the city, however, is the famous one at Puna Hou college, which is 500 feet long and composed of night-blooming *cereus*. I was not fortunate enough to see this when it was in full flower, but I saw a photograph of it when it was estimated that there were about 8,000 flowers at one time.

Of the fruit trees ordinarily grown, the following may be mentioned. The mango is a very handsome tree with dense dark green foliage and masses of yellow and reddish fruit on long hanging stalks. The bread-fruit tree is common, both cultivated and wild, and is a very beautiful tree of moderate size with leaves looking like immense fig-leaves, and the fruit like a large osage orange. I saw no ripe fruit, and so had not an opportunity of testing its quality. Guavas of different varieties are extremely common both wild and cultivated, and the various fruits of the whole citrus tribe grow well. The few specimens of temperate fruits were, for the most part, much inferior to those of the United States. Of the fruits that did not strike my fancy, at least at first, was the alligator pear (*Persea gratissima*), a big green or purple pear-shaped fruit with an immense single seed. The pulp is somewhat waxy in consistence and very oily. It is eaten as a salad, and very much relished by the islanders, but the taste is acquired. The curious papaya (*Carica papaya*) is another fruit which did not appeal to my palate. Its big orange fruit, not unlike a

melon in appearance when cut open, has a peculiar "squashy" flavor that suggested its having been kept a day too long.

Many showy climbers are planted, some of which, like *Stephanotis*, *Thunbergia* and *Allamanda*, are superb; but there is one that is particularly obnoxious in color, *Bougainvillea*, whose magenta floral-bracts are an offense to the eye, forming a cataract of raw color. It looks, as some one observed, as if it had just come from a chemical bath.

As soon as one gets fairly away from the city, it is at once seen that all the luxuriant vegetation is strange. Along the seashore is a plain gradually rising into low hills, both almost destitute of trees, except here and there a few cocoa palms along the shore. Of the strictly littoral plants among the most conspicuous is the curious *Ipomœa pes-capræ*, with deeply two-cleft leaves and purplish pink flowers. In the fertile lowlands near the sea are the principal cane and rice fields, which with taro are the staple crops. The rice is cultivated entirely by Chinese, near Honolulu; but on the sugar plantations the Japanese are largely employed. To see a Chinese laboriously transplanting little handfuls of rice into straight rows, or plowing in the mud and water with a primitive plow drawn by a queer Chinese buffalo are sights very foreign to an American eye. Sugar cane is eminently productive in the islands, and, hitherto, has proved the main source of revenue; but now the Hawaiians are bewailing the depression caused by the free admission of sugar from other countries into the United States; as, hitherto, their product has enjoyed practically a monopoly of the American market, having been admitted by treaty free of duty.

I made several trips up the valleys back of the city, but owing to the almost constant rain in many of them, these were not always agreeable. However, one is richly repaid by the luxuriance and variety of the vegetation. For a mile or two we pass between grass-covered hills, or hills overgrown in places with the lantana, which, introduced as an ornamental plant, has become a great pest. This plant covers some of the hills with an absolutely impassable thicket and spreads very rapidly, so that it is a serious problem what is to be done with it. Of the common roadside plants, an orange and yellow milk-weed and the showy white *Argemone Mexicana* were the most conspicuous. As one proceeds farther, where more moisture prevails, the variety becomes larger. Thickets of *Canna* and a *Clerodendron* with double rosy-white flowers,

are common, and the curious screw-pine (*Pandanus odoratissimus*) is occasionally seen. This latter is a very characteristic plant, but is much more abundant in some of the other islands. In this region several very showy species of *Ipomœa* are very common, among them the well-known moon-flower, *I. bona-nox*.

With the increase in moisture, as might be expected, the mosses and ferns increase in number and beauty. There are many of them of types quite different from those of the United States. One of the commonest ferns of the lower elevations is *Microlepia tenuifolia*, a very graceful fern with finely divided leaves and terminal sori. Species of *Vittaria*, with very long undivided leaves, are also common here.

As we ascend one of the commonest ferns is *Sadleria cyatheoides*, a very large fern, often more or less arborescent. Ascending still higher the number and variety of ferns increases rapidly, and many beautiful and interesting ferns and mosses and liverworts become common.

At about one thousand feet elevation we begin to meet with species of *Cibotium*, to which genus belong the largest of the tree ferns of the islands. Here, also, I met for the first time with the smallest of all the ferns I have ever seen, *Trichomanes pusillum*. This dainty little fern, one of the *Hymenophyllaceæ*, forms dense mats on rocks and tree-trunks, looking like a delicate moss. The full grown frond is fan-shaped and, with its stalk, is not more than half an inch high. These tiny leaves, nevertheless, in many cases bore sporangia.

With the increase in the amount of moisture, the epiphytic ferns become frequent. The principal ones we notice are species of *Acrostichum*, *Polypodium*, and, most conspicuous of all, the beautiful bird's-nest fern (*Asplenium nidus*), with immense bright green entire leaves. This superb plant is not at all uncommon in the forks of trees in the lower forest region.

Everywhere in this region are thickets of *Freycinetia*, sometimes even climbing the trees. This plant, looking very much like a *Pandanus*, is troublesome to get through, and often have we found ourselves walking on the tops of the bushes, three or four feet above the ground. As frequent tough convolvuli and ipomœas kept entangling our legs, progress was rather slow.

(To be concluded.)

Leland Stanford Junior University.